

# SN54HC7076, SN74HC7076 6-SECTION MULTIFUNCTION (INVERT, NOR, FLIP-FLOP) CIRCUITS

D2880, MARCH 1985—REVISED SEPTEMBER 1987

- Contains D-type Flip-Flops with Preset and Clear, NOR and Inverter Gates
- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs
- Dependable Texas Instruments Quality and Reliability

## description

The SN54HC7076 and SN74HC7076 are each comprised of the following sections:

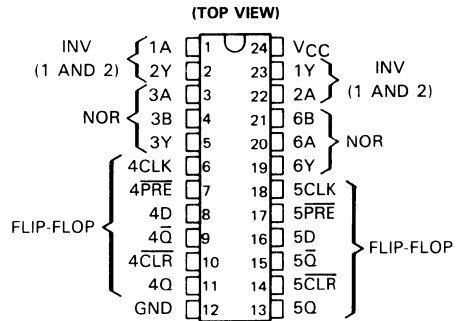
- Two inverters
- Two 2-input NOR gates
- Two D-type flip-flops

They perform the Boolean functions shown under the respective function table.

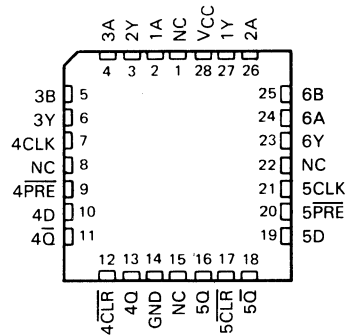
The D-type flip-flops are positive-edge-triggered and are functionally similar to the SN54HC74 and SN74HC74. A low level at the  $\overline{PRE}$  or  $\overline{CLR}$  inputs sets or resets the outputs regardless of the levels of the other inputs. When  $\overline{PRE}$  and  $\overline{CLR}$  are inactive (high), data at the D input meeting the setup time requirements are transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not directly related to the rise time of the clock pulse. Following the hold time interval, data at the D input may be changed without affecting the levels at the outputs.

The SN54HC7076 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74HC7076 is characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

SN54HC7076 . . . JT PACKAGE  
SN74HC7076 . . . DW OR NT PACKAGE



SN54HC7076 . . . FK PACKAGE  
(TOP VIEW)



NC—No internal connection

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PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

TEXAS  
INSTRUMENTS

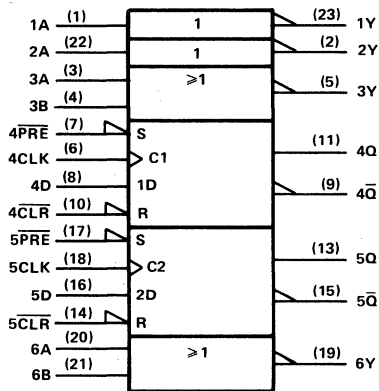
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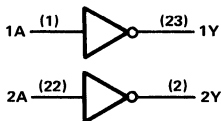
logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for DW, JT, and NT packages.

logic diagrams (positive logic)

## INVERTERS

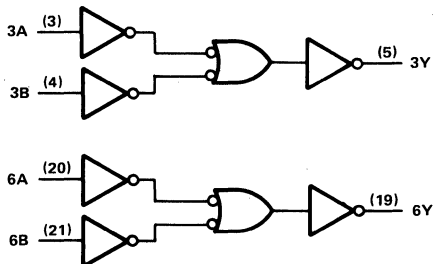


FUNCTION TABLE  
(EACH INVERTER)

INPUT		OUTPUT
A	Y	
H	L	
L	H	

positive logic:  $Y = \bar{A}$

## 2-INPUT NOR GATES



FUNCTION TABLE

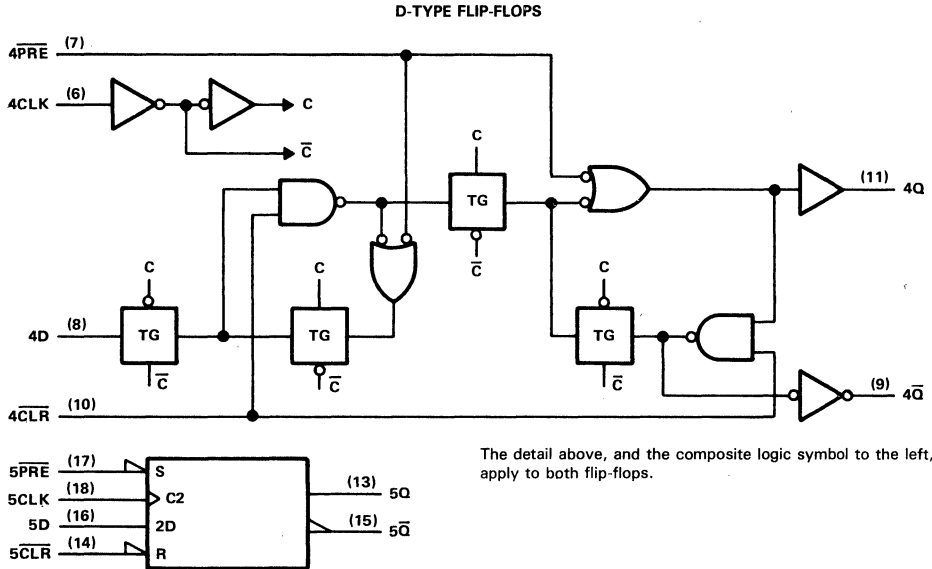
INPUTS		OUTPUT
A	B	Y
H	X	L
X	H	L
L	L	H

positive logic:  $Y = \overline{A \cdot B}$  or  $Y = \bar{A} + \bar{B}$

Pin numbers shown are for DW, JT, and NT packages.

**SN54HC7076, SN74HC7076**  
**6-SECTION MULTIFUNCTION**  
**(INVERT, NOR, FLIP-FLOP) CIRCUITS**

logic diagrams (positive logic)



**FUNCTION TABLE**  
**(EACH D FLIP-FLOP)**

INPUTS				OUTPUTS	
PRE	CLR	CLK	D	Q	Q̄
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H*	H*
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q <sub>0</sub>	Q̄ <sub>0</sub>

\*This configuration is nonstable: i.e., it will not persist when either PRE or CLR returns to the inactive (high) level.

Pin numbers shown are for DW, JT, and NT packages.

# SN54HC7076, SN74HC7076

## 6-SECTION MULTIFUNCTION

### (INVERT, NOR, FLIP-FLOP) CIRCUITS

#### absolute maximum ratings over operating free-air temperature range†

Supply voltage, $V_{CC}$ .....	-0.5 V to 7 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) .....	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) .....	$\pm 20$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....	$\pm 25$ mA
Continuous current through $V_{CC}$ or GND pins .....	$\pm 50$ mA
Lead temperature 1,6 mm (1/16 in) from case for 60 s: FK or JT package .....	300°C
Lead temperature 1,6 mm (1/16 in) from case for 10 s: DW or NT package .....	260°C
Storage temperature range .....	-65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

#### recommended operating conditions

		SN54HC7076			SN74HC7076			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	2	5	6	2	5	6	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2$ V	1.5		1.5			V
		$V_{CC} = 4.5$ V	3.15		3.15			
		$V_{CC} = 6$ V	4.2		4.2			
$V_{IL}$	Low-level input voltage	$V_{CC} = 2$ V	0	0.3	0	0.3	V	
		$V_{CC} = 4.5$ V	0	0.9	0	0.9		
		$V_{CC} = 6$ V	0	1.2	0	1.2		
$V_I$	Input voltage	0	$V_{CC}$		0	$V_{CC}$		V
$V_O$	Output voltage	0	$V_{CC}$		0	$V_{CC}$		V
$t_t$	Input transition (rise and fall) times	$V_{CC} = 2$ V	0	1000	0	1000	ns	
		$V_{CC} = 4.5$ V	0	500	0	500		
		$V_{CC} = 6$ V	0	400	0	400		
$T_A$	Operating free-air temperature	-55		125	-40		85	°C

#### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54HC7076		SN74HC7076		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$V_{OH}$	$V_I = V_{IH}$ or $V_{IL}$ , $I_{OH} = -20 \mu\text{A}$	2 V	1.9	1.998		1.9		1.9	V	
		4.5 V	4.4	4.499		4.4		4.4		
		6 V	5.9	5.999		5.9		5.9		
		4.5 V	3.98	4.30		3.7		3.84		
$V_{OL}$	$V_I = V_{IH}$ or $V_{IL}$ , $I_{OL} = 20 \mu\text{A}$	2 V		0.002	0.1		0.1	0.1	V	
		4.5 V		0.001	0.1		0.1	0.1		
		6 V		0.001	0.1		0.1	0.1		
		4.5 V		0.17	0.26		0.4	0.33		
$I_I$	$V_I = V_{CC}$ or 0	6 V		$\pm 0.1$	$\pm 100$		$\pm 1000$	$\pm 1000$	nA	
		6 V			4		80	40	$\mu\text{A}$	
$I_{CC}$	$V_I = V_{CC}$ or 0, $I_O = 0$	6 V							$\mu\text{A}$	
$C_i$		2 to 6 V		3	10		10	10	pF	

**SN54HC7076, SN74HC7076**  
**6-SECTION MULTIFUNCTION**  
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**timing requirements for each D-type flip-flop over recommended operating free-air temperature range (unless otherwise noted)**

		V <sub>CC</sub>	T <sub>A</sub> = 25 °C			SN54HC7076		SN74HC7076		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f <sub>clock</sub>	Clock frequency	2 V	0		5.6	0	3.8	0	4.5	MHz
		4.5 V	0		28	0	19	0	22	
		6 V	0		31	0	21	0	25	
t <sub>w</sub>	Pulse duration	CLK high	2 V	90		135		110	ns	
		or	4.5 V	18		26		23		
		CLK low	6 V	16		24		20		
	PRE low	2 V	100		150		125			
		4.5 V	20		30		25			
CLR low	6 V	17		25		21				
t <sub>su</sub>	Setup time before CLK↑	Data	2 V	100		150		125	ns	
			4.5 V	20		30		25		
			6V	17		25		21		
		PRE high	2 V	25		38		30		
			4.5 V	5		8		6		
			6 V	4		7		5		
t <sub>h</sub>	Hold time, data after CLK↓	2 V	5		5		5	ns		
		4.5 V	5		5		5			
		6 V	5		5		5			

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**switching characteristics for each D-type flip-flop over recommended operating free-air temperature range (unless otherwise noted), C<sub>L</sub> = 50 pF (see Note 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25 °C			SN54HC7076		SN74HC7076		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f <sub>max</sub>			2 V	5.6	10		3.8		4.5	MHz	
			4.5 V	28	50		19		22		
			6 V	31	60		21		25		
t <sub>pd</sub>	CLK	Q or Q̄	2 V		45	175		263		219	ns
			4.5 V		15	35		53		44	
			6 V		13	30		45		38	
t <sub>pd</sub>	PRE or CLR	Q or Q̄	2 V		45	230		345		288	ns
			4.5 V		15	46		69		58	
			6 V		13	39		59		49	

C <sub>pd</sub>	Power dissipation capacitance per flip-flop	No load, T <sub>A</sub> = 25 °C	40 pF typ
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**SN54HC7076, SN74HC7076**  
**6-SECTION MULTIFUNCTION**  
**(INVERT, NOR, FLIP-FLOP) CIRCUITS**

switching characteristics for gates and inverters over recommended operating free-air temperature range (unless otherwise noted),  $C_L = 50$  pF (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HC7076		SN74HC7076		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A or B	Y	2 V		24	90	135		115		ns
			4.5 V		9	18	27		23		
			6 V		7	15	23		20		
t <sub>t</sub>		Y	2 V		38	75	110		95		ns
			4.5 V		8	15	22		19		
			6 V		6	13	19		16		

C <sub>pd</sub>	Power dissipation capacitance per NOR gate	No load, T <sub>A</sub> = 25°C	27 pF typ
	Power dissipation capacitance per inverter		20 pF typ

Note 1: Load circuits and voltage waveforms are shown in Section 1.